KEY

AP Statistics
Section 5.1B – Binomial Distribution

1. Which of the following are binomial experiments or can be reduced to binomial experiments?

   a. Surveying 100 people to determine if they like Sudsy Soap. YES
   b. Tossing a coin 100 times to see how many heads occur. YES
   c. Drawing a card from a deck and getting a heart. (no replacement) NO
   d. Asking 1000 people which brand of cigarettes they smoke. NO
   e. Testing 4 different brands of aspirin to see which brands are effective. NO
   f. Testing 1 brand of aspirin using 10 people to determine whether it is effective. YES
   g. Asking 100 people if they smoke. YES
   h. Checking 1000 applicants to see whether they were admitted to White Oak College. YES
   i. Surveying 300 prisoners to see how many different crimes they were convicted of. NO
   j. Surveying 300 prisoners to see whether this is their first offense. YES

2. A burglar alarm system has 6 fail-safe components that act independently. The probability of each failing is .05. Find the following probabilities.

   a. Exactly 3 will fail. $P(x=3) = \text{binompdf}(6, 0.05, 3) = 0.0021$

   b. Fewer than 2 will fail. $P(x<2) = P(x \le 1) = \text{binomcdf}(6, 0.05, 1) = 0.9$

   c. None will fail. $P(x=0) = \text{binompdf}(6, 0.05, 0) = 0.7351$

3. If a student takes a 10-question multiple choice quiz with four choices for each question, find the probability of guessing at least 6 correct.

   $P(x \ge 6) = 1 - P(x \le 5) = 1 - \text{binomcdf}(10, 0.25, 5)$
   $= 0.0197$

4. In a Gallup survey, 90% of the people interviewed were unaware that maintaining a healthy weight could reduce the risk of stroke. If 15 people are selected at random, find the probability that at least 9 are unaware that maintaining a proper weight could reduce the risk of stroke.

   $P(x \ge 9) = 1 - P(x \le 8)$
   $= 1 - \text{binomcdf}(15, 0.9, 8)$
   $= 0.9997$

5. It was found that 60% of American victims of health care fraud are senior citizens. If 10 victims are randomly selected, find the probability that exactly 3 are senior citizens.

   $P(x=3) = \text{binompdf}(10, 0.6, 3) = 0.0425$

6. Find the following probabilities for a sample of 9 children if 60% of them had German measles by the time they were 12 years old. $n = 9,\ p = 0.60$

   a. At least 5 have had German measles.

   $P(x \ge 5) = 1 - P(x \le 4) = 1 - \text{binomcdf}(9, 0.6, 4)$
   $= 0.7334$

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b. Exactly 7 have had German measles. $P(X=7) = \text{binompdf}(9, 0.6, 7) = 0.1612$

c. More than 3 have had German measles.
$P(X>3) = P(X \geq 4) = 1 - P(X \leq 3) = 1 - \text{binomcdf}(9, 0.6, 3) = 0.9006$

7. Find the mean, variance, and standard deviation for the number of heads when 10 coins are tossed.

$\mu_X = n \cdot p = (10)(0.5) = 5$ $\sigma_X^2 = (1.5811)^2 = 2.5$

$\sigma_X = \sqrt{(n)(p)(1-p)} = \sqrt{(10)(0.5)(0.5)} = 1.5811$

8. It has been reported that 83% of federal government employees use e-mail. If a sample of 200 federal government employees is selected, find the mean and standard deviation of the number of people who use e-mail.

$p = 0.83$
$n = 200$

$\mu = 166$
$\sigma = 5.3122$

9. For the data in #8, what is the probability that the number of people using e-mail will lie $\boxed{\text{within}}$ one standard deviation of the mean? ~~Two standard deviations? Three standard deviations?~~ 1σ

$P(160.688 \leq X \leq 171.3122)$
$P(161 \leq X \leq 171) = \text{binomcdf}(200, 0.83, 171) - \text{binomcdf}(200, 0.83, 160)$
$= 0.69985$

10. In a restaurant, a study found that 42% of all patrons smoked. If the seating capacity of the restaurant is 80 people, find the mean, variance and standard deviation for the number of patrons smoking.

$\mu_X = 33.6$ $\sigma_X^2 = 19.488$
$\sigma_X = 4.4145$

11. For the data in #10, what is the probability that the number of smokers will lie $\boxed{\text{within}}$ 1.5 standard deviations of the mean?

2σ
$P(155.38 \leq X \leq 176.62)$
$P(156 \leq X \leq 176)$
$= 0.9526$

3σ
$P(150.0634 \leq X \leq 181.936)$
$P(151 \leq X \leq 181)$

$P(26.978 \leq X \leq 40.22175)$
$P(27 \leq X \leq 40)$
$\text{binomcdf}(80, 0.42, 40)$
$- \text{binomcdf}(80, 0.42, 26)$
$= 0.8877$